What is the effect of a charge between light and heavy cavalry, the light cavalry having the greater energy and the heavy the greater momentum?

7. Proposed by DE VOLSON WOOD, M. A., M. Sc., C. E., Professor of Engineering, Stevens Institute of Technology, Hoboken, New Jersey.

A hollow sphere filled with frictionless water rolls down a rough plane whose length is l and inclination θ; when half way down the water suddenly freezes and adheres to the sphere. Required the time of the descent.

8. Proposed by ALFRED HUME, C. E., D. Sc., Professor of Mathematics in the University of Mississippi.

A heavy bar AB of length a falls about its lower end B from a vertical to a horizontal position, when the end A is suddenly fixed and B is set free, so that the bar falls into a vertical position AB as at first; then A is set free, and B is fixed, so that the bar again falls about B into a horizontal position, when the end A is suddenly fixed, and B is set free, and so on; find the angular velocity ω of the bar about the upper end, when it takes a vertical position for the nth time.

[Selected from *Price's Infinitesimal Calculus.*]

SOLUTION TO THE CELEBRATED INDETERMINATE EQUATION.

$$x^2 - Ny^2 = \pm 1.$$

To obtain the values of x and y, in integers, without taking the square root of N, by continued fractions. On account of requiring a certain class of non-quadrate numbers for N, to satisfy the -1, and causing more or less confusion, this part is set aside for future time. The $+1$ is found in all values of N, and our equation becomes $x^2 = Ny^2 + 1$.

Then $Ny^2 + 1 = \square = \left\{ \frac{mNy}{n} - 1 \right\}^2$ when reduced easily gives

$$y = \frac{2mn}{m^2 N - n^2}, \text{ and } x = \frac{mNy}{n} - 1, \ldots\ldots (A)$$

Let $\frac{m}{n} = \frac{1}{2}$, then $y = \frac{4}{N-4}$. Let $N = 2, 3, \square, 5, 6, 8, \square$

then $y =$	2	4	4	2	1	
$x =$	3	7	9	5	3	

$\frac{m}{n} = \frac{1}{3}$, and $y = \frac{6}{N-9}$,

$N = 3, 7, 8, 10, 11, 12, (13),$

$y =$	1	3	6	6	3	2
$x =$	2	8	17	19	10	7

$\frac{m}{n} = \frac{1}{4}$, and $y = \frac{8}{N-16}$,

$N = 14, 15, \square, 17, 18, (19), 20,$

$y =$	4	8		8	4	2,
$x =$	15	31		33	17	9

$\frac{m}{n} = \frac{1}{5}$, $y = \frac{10}{N-25}$,

$N = 15, (21), (22), 23, 24, \square, 26, 27, (28), (29), 30,$

$y =$	1			5	10		10	5		2
$x =$	4			24	49		51	26		11

$\frac{m}{n} = \frac{1}{6}$, $y = \frac{12}{N-36}$,

$N = 24, (31), 32, 33, 34, 35, \square, 37, 38, 39, 40, (41), 42,$

$y =$	1		3	4	6	12		12	6	4	3	2
$x =$	5		17	23	35	71		73	37	25	19	13

$$\frac{m}{n}=\frac{1}{7},\qquad y=\frac{14}{N-49},\qquad \begin{array}{l} N=35,(43),(44),(45),(46),47,48,\square,50,51,(52),(53),\\ y=1 \qquad\qquad\qquad\qquad\qquad\quad 7\ \ 14\quad 14\ \ 7\\ x=6 \qquad\qquad\qquad\qquad\qquad\quad 48\ \ 97\quad 99\ \ 50 \end{array}$$

$$\underset{15}{\underset{2}{(54),(55),56,}}$$

$$\frac{m}{n}=\frac{1}{8},\qquad y=\frac{16}{N-64},\qquad \begin{array}{l} N=48,57,58,59,60,61,62,63,\square,65,66,67,68,69,\\ y=1 \qquad\quad 4 \qquad 8\ 16 \qquad 16\ \ 8 \qquad 4\\ x=7 \qquad\quad 31 \qquad 63\ 27\ 129 \qquad 65 \end{array}$$

$$\underset{17}{\underset{2}{70,71,72,}}$$

$$\frac{m}{n}=\frac{1}{9},\qquad y=\frac{18}{N-81},\qquad \begin{array}{l} N=63,73,74,75,76,77,78,79,80,\square,82,83,84,85,\\ y=1 \qquad\quad 3 \qquad\quad 6\ \ 9\ \ 18 \qquad 18\ \ 9\ \ 6\\ x=8 \end{array}$$

$$\underset{19}{\underset{2}{\underset{2}{86,87,88,89,90,}}}$$

$$\frac{m}{n}=\frac{1}{10},\qquad y=\frac{20}{N-100},\qquad \begin{array}{l} N=80,91,92,93,94,95,96,97,98,99,\square,101,102,\\ y=1 \qquad\qquad\quad 4\ \ 5 \qquad 10\ 20\ 20 \qquad 10\\ x= \end{array}$$

$$\underset{5}{103,}\ \underset{4}{104,}105,106,107,\underset{2}{108,110,}$$

It is seen that the position of the numbers N, between the two consecutive square numbers, determines the ease of obtaining the values of x and y. As, let a^2 and a_2^2, represent the two squares, then in $a^2+a, y=2$, in numbers N, of the form of $a^2+2a, y=1$. The more complex numbers are always found midway between a^2+a and a^2+2a.

There are two values of x and y, N being of the form of a^2-1. It is, however, the second higher value of x and y, as x_2 and y_2.

Other series can easily be found giving, the values also in a regular series.

A. H. BELL, Hillsboro, Illinois.

(TO BE CONTINUED.)

AVERAGE AND PROBABILITY.

Conducted by B. F. FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

Solution to a Problem by Professor G. B. M. ZERR, A. M., Principal of Schools, Staunton, Virginia.

Three persons *A.*, *B.*, *C.*, throw with three dice. They each stake $10, and the one who first throws exactly 10 with the three dice, takes the whole stake. Find the expectation of each.

There is probably no subject that is more interesting than the subject of Average and Probability, and that part of this subject that deals